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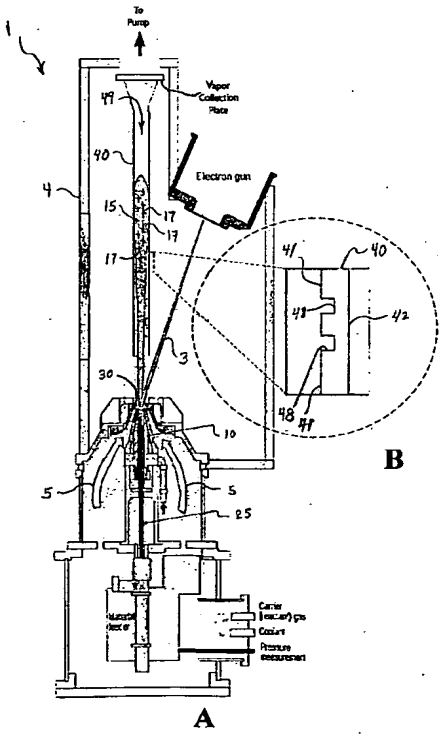
(54) Title: APPARATUS AND METHOD FOR APPLYING COATINGS ONTO THE INTERIOR SURFACES OF COMPONENTS AND RELATED STRUCTURES PRODUCED THEREFROM



(57) Abstract: Provided is a methodology and system for applying coatings onto the interior surfaces of components. The approach comprises a vapor creation device (for example an electron beam or laser that evaporates a single or multiplicity of solid or liquid sources), a vacuum chamber having a moderate gas pressure (between about 10^{-4} to about 10^{3} Torr) and a inert gas jet having controlled velocity and flow fields of gas jet. The gas jet is created by a rarefied, inert gas supersonic expansion through a nozzle. By controlling the carrier gas flow into a region upstream of the nozzle an upstream pressure is achieved (i.e. the gas pressure prior to its entrance into the processing chamber through the nozzle). The carrier gas flow and chamber pumping rate control the downstream (or chamber) pressure (i.e., downstream of the nozzle). The ratio of the upstream to downstream pressure along with the size and shape of the nozzle opening controls the speed of the gas entering the chamber. The carrier gas molecular weight (compared to that of the vapor) and the carrier gas speed controls its effectiveness in redirecting the vapor atoms via binary collisions towards the substrate. The speed and flux of the atoms entering the chamber, the nozzle parameters, and the operating chamber pressure can all vary leading to a wide range of accessible processing conditions. Vapor created from a source is transported into the interior regions of a component using binary collisions between the vapor and gas jet atoms. Under certain process conditions these collisions enable the vapor atoms to scatter onto the interior surfaces of the component and deposit.

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